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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/937,027	09/19/2001	Bernhard Raaf	112740-283	3093
29177	7590	04/20/2006	EXAMINER	
BELL, BOYD & LLOYD, LLC P. O. BOX 1135 CHICAGO, IL 60690-1135			MERED, HABTE	
			ART UNIT	PAPER NUMBER
			2616	

DATE MAILED: 04/20/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/937,027

Applicant(s)

BERNHARD ET A

Examiner

Habte Mered

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 10-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 10-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 19 September 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. The amendment filed on 1/9/2006 has been entered and fully considered.
2. Claims 10-20 are pending.
3. The indicated allowability of claims 12-17 is withdrawn in view of the newly discovered reference(s) to 3GPP (3GPP TS 25.212 "UMTS: Multiplexing and Channel Coding", Version 3.5.0, ETSI, 1999). Rejections based on the newly cited reference(s) follow. Examiner sincerely apologizes for the inconvenience.

Claim Objections

4. Claims 10, 11, 12 and 18 are objected to because of the following informalities: the variable "q" is not defined in the claim. Appropriate correction is required.
5. Claim 14 is objected to because the first "q=" in the claim has to be changed to "q". Appropriate correction is required.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 10, 11, and 18** are rejected under 35 U.S.C. 103(a) as being unpatentable over Eroo et al (US 6, 370, 669), hereinafter referred to as Eroo, in view of Lee et al (US 6, 289, 486), hereinafter referred to as Lee.

Eroz discloses a method and apparatus for Turbo encoding using a set of rate-compatible Turbo codes optimized at high code rates. The Turbo codes have rate-compatible puncturing patterns.

8. Eroz discloses a method and apparatus for data rate matching, the method comprising the steps of distributing data to be transmitted in the form of bits via a first interleaver to a set of K frames (**See Figure 2, elements 204, 208, and 212 and Column 5, Lines 52-67 and Column 6, Lines 28-41**); carrying out a puncturing or repetition method for data rate matching after interleaving (**See in Figure 3 puncturing occurring after interleaving and also refer to Column 7, Lines 1-5**); and varying a distance between punctured or repeated bits with regard to the sequence of the bits before the first interleaver, for puncturing or repeating the same number of bits in each frame (**Column 7, Lines 15-35**).

Eroz fails to disclose the distance between punctured bits can be defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q, K) + 1$, where $q := (\lfloor N_c / (|N_i - N_c|) \rfloor) \bmod K$, where $\lfloor \cdot \rfloor$ refers to rounding down and $| \cdot |$ refers to absolute value, and where $N_i :=$ the number of bits after rate matching, $N_c :=$ the number of bits before rate matching; and $\text{lcd}(q, K) :=$ highest common denominator of q and K . Eroz also fails to disclose a form of circular shifting interleaving wherein a puncturing or repetition process is carried out in such a manner that the puncturing or repetition pattern used within a frame is also shifted and used within further frames in the set of frames.

Lee teaches an adaptive channel encoder.

Lee discloses the distance between punctured bits can be defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q, K) + 1$, where $q := (\lfloor N_o / (|N_i - N_c|) \rfloor) \bmod K$, where $\lfloor \cdot \rfloor$ refers to rounding down and $| \cdot |$ refers to absolute value, and where $N_i :=$ the number of bits after rate matching, $N_c :=$ the number of bits before rate matching; and $\text{lcd}(q, K) :=$ highest common denominator of q and K . **(Lee discloses an interleaving operation based on the greatest common factor of the columns and rows (M,N) and the mathematical relation show by the Applicant can be deduced from equation 1 shown in Column 6 and from the mathematical steps shown in Figures 9-11. Also See Equations 2-5 that exhibit similar relationship to that of the mathematical relationship shown by the Applicant.)** Lee also teaches a form of circular shifting interleaving wherein a puncturing or repetition process is carried out in such a manner that the puncturing or repetition pattern used within a frame is also shifted and used within further frames in the set of frames. **(See Figures 10 and 11 and Column 8, Lines 19-25 and Column 9, Lines 18-25)**

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Eroz's apparatus to incorporate a special mathematical relationship that determines the distance between the punctured bits and a form of circular shifting interleaving. The motivation is that minimizing the distance between the punctured bits increases error correction efficiency and using circular shifting interleaving allows the system to handle any size frame as illustrated in Lee Column 3, Lines 1-5.

9. **Claims 12, and 14-17** are rejected under 35 U.S.C. 103(a) as being unpatentable over Eroz in view of Lee as applied to claim 10 above, and further in view of 3GPP (3GPP TS 25.212 "UMTS: Multiplexing and Channel Coding", Version 3.5.0, ETSI, 1999).

10. Regarding **claims 12, 16, and 17**, the combination of Eroz and Lee disclose all aspects of the claimed invention as set forth in the rejection of claim 10 but does not disclose a method for data rate matching, wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver are obtained by a method which comprises the steps of: puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; and varying the distance to $q-1$ or $q+1$ between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; and continuing with the step of puncturing if any further bits need to be punctured or repeated.

3GPP teaches the European Telecommunication Standards for layer 1 multiplexing and channel coding in the FDD mode of UTRA.

3GPP teaches a method for data rate matching, wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver **(See Figures 1 and 2)** are obtained by a method which comprises the steps of:

puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; (See Section 4.2.4 on page 20) and varying the distance to $q-1$ or $q+1$ between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; and continuing with the step of puncturing if any further bits need to be punctured or repeated. (See Section 4.2.5.1 on page 21)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the combination of Eroz's and Lee's method to incorporate a special method of data rate matching based on European Telecommunication Standards that varies the distance to $q-1$ or $q+1$ between adjacent punctured bits. The motivation is that varying the distance between the punctured bits increases error correction efficiency and complying with the Standards enhances interoperability of interleavers from different manufacturers.

11. Regarding **claims 14 and 15**, the combination of Eroz and Lee disclose all aspects of the claimed invention as set forth in the rejection of claim 10 but does not disclose a method for calculating a mean puncturing distance in a data rate matching method, wherein the shift $V(k) = S(k) + T(k) * Q$ in the use of the puncturing or repetition pattern to the frame k can be produced via the steps of:

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calculating a mean puncturing distance q , using $q := \left(\lfloor N_o / (|N_i - N_c|) \rfloor \right)$ where $\lfloor \cdot \rfloor$ refers to rounding down and $| \cdot |$ refers to absolute value, and in which case: $N_i :=$ the number of bits after rate matching, $N_c :=$ the number of bits before rate matching; calculating Q , in which case: $Q := \left(\lfloor N_o / (|N_i - N_c|) \rfloor \right) \text{ div } K$;

if q is even, then q is set to $q - \text{lcd}(q, K)/K$ where $\text{lcd}(q, K) :=$ the highest common denominator of q and K ; - a variable i is set to zero; and

repeating the following steps as long as $i \leq K-1$:

$S(R_K(r \cdot i \cdot q \cdot \tau \bmod K)) = (r \cdot i \cdot q \cdot \tau \text{ div } K)$, where $r \cdot \tau$ refers to rounding; $T(R_K(r \cdot i \cdot q \cdot \tau \bmod K)) = i$, where $R_K(k)$ reverses the interleaver; and i becomes $i + 1$. **(See**

Section 4.2.7.1.2 on pages 27 and 28)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the combination of Eroz's and Lee's method to incorporate a special method of data rate matching based on European Telecommunication Standards that calculates a mean puncturing distance. The motivation is that use of mean puncturing distance in the data rate matching portion of the interleaving process increases error correction efficiency and complying with the Standards enhances interoperability of interleavers from different manufacturers.

12. **Claims 19 and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over Eroz et al (US 6, 370, 669), hereinafter referred to as Eroz, in view of Lee et al (US 6, 289, 486), hereinafter referred to as Lee and 3GPP (3GPP TS 25.212 "UMTS: Multiplexing and Channel Coding", Version 3.5.0, ETSI, 1999).

Eroz discloses a method and apparatus for data rate matching, the method comprising the steps of distributing data to be transmitted in the form of bits via a first interleaver to a set of K frames (**See Figure 2, elements 204, 208, and 212 and Column 5, Lines 52-67 and Column 6, Lines 28-41**); carrying out a puncturing or repetition method for data rate matching after interleaving (**See in Figure 3 puncturing occurring after interleaving and also refer to Column 7, Lines 1-5**); and varying a distance between punctured or repeated bits with regard to the sequence of the bits before the first interleaver, for puncturing or repeating the same number of bits in each frame (**Column 7, Lines 15-35**).

Eroz fails to disclose the distance between punctured bits can be defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q, K) + 1$, where $q := (\lfloor N_o / (|N_i - N_o|) \rfloor) \bmod K$, where $\lfloor \cdot \rfloor$ refers to rounding down and $| \cdot |$ refers to absolute value, and where $N_i :=$ the number of bits after rate matching, $N_o :=$ the number of bits before rate matching; and $\text{lcd}(q, K) :=$ highest common denominator of q and K . Eroz also fails to disclose a form of circular shifting interleaving wherein a puncturing or repetition process is carried out in such a manner that the puncturing or repetition pattern used within a frame is also shifted and used within further frames in the set of frames.

Lee discloses the distance between punctured bits can be defined by the following relationship:

$q-1 \leq \text{distance} \leq q + \text{lcd}(q, K) + 1$, where $q := (\lfloor N_o / (|N_i - N_o|) \rfloor) \bmod K$, where $\lfloor \cdot \rfloor$ refers to rounding down and $| \cdot |$ refers to absolute value, and where $N_i :=$ the number of bits

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after rate matching, N_c := the number of bits before rate matching; and $\text{lcd}(q, K)$:= highest common denominator of q and K . **(Lee discloses an interleaving operation based on the greatest common factor of the columns and rows (M,N) and the mathematical relation show by the Applicant can be deduced from equation 1 shown in Column 6 and from the mathematical steps shown in Figures 9-11. Also See Equations 2-5 that exhibit similar relationship to that of the mathematical relationship shown by the Applicant. See also Figures 10 and 11 and Column 8, Lines 19-25 and Column 9, Lines 18-25)**

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Eroz's apparatus to incorporate a special mathematical relationship that determines the distance between the punctured bits. The motivation is that minimizing the distance between the punctured bits increases error correction efficiency as illustrated in Lee Column 2, Lines 55-60.

Eroz also fails to disclose a method for data rate matching, wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver are obtained by a method which comprises the steps of: puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; and varying the distance to $q-1$ or $q+1$ between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver

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between adjacent punctured or repeated bits of magnitude q ; and continuing with the step of puncturing if any further bits need to be punctured or repeated.

3GPP teaches a method for data rate matching, wherein punctured or repeated bits which are adjacent to the sequence of bits before the first interleaver **(See Figures 1 and 2)** are obtained by a method which comprises the steps of: puncturing or repetition with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; **(See Section 4.2.4 on page 20** and varying the distance to $q-1$ or $q+1$ between adjacent punctured or repeated bits, if the number of punctured or repeated bits in a frame would exceed the number of punctured or repeated bits in another frame by more than one, and if the puncturing or repetition were carried out with a distance with regard to the sequence of the bits before the first interleaver between adjacent punctured or repeated bits of magnitude q ; and continuing with the step of puncturing if any further bits need to be punctured or repeated. **(See Section 4.2.5.1 on page 21)**

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify Erož's method to incorporate a special method of data rate matching based on European Telecommunication Standards that varies the distance to $q-1$ or $q+1$ between adjacent punctured bits. The motivation is that varying the distance between the punctured bits increases error correction efficiency and complying with the Standards enhances interoperability of interleavers from different manufacturers.

Response to Arguments

13. Applicant's arguments with respect to claims 10, 11, and 18 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The following also disclose similar subject matter:

US Patent (6, 622, 2810) to Yun et al

US Patent (6, 543, 013) to Li et al

US Patent (6, 427, 214) to Li et al

US Patent (6, 430, 722) to Eroz et al

International Pub. (WO 99/23798) to Ramesh

Correspondence


15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Habte Mered whose telephone number is 571 272 6046. The examiner can normally be reached on Monday to Friday 9:30AM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hassan Kizou can be reached on 571 272 3088. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

HM
04-17-2006



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